Top tips for managing enamel infractions, cracks and fractures – Part 2: Management

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In Part 2 of this two-part series, we offer top tips for management of problems associated with tooth infractions, cracks and fractures (ICF). Restorative intervention must be preceded by a comprehensive assessment, and (at least a provisional) diagnosis.

1. Patient discussions related to management of ICF

a. The prognosis for teeth with ICFs is largely dependent on the location and extent of break(s), and whether or not the defect(s) extend below the attachment level. However, there is often uncertainty about the absolute depth of any given ICF, and whether its further propagation can be ultimately arrested.

b. The consent process should include discussion about: the uncertain outcome for cracked/fractured teeth; potential for pulpal complications (if these are not already manifesting); potential need for root canal treatment (RCT); or, need for extraction if symptoms do not settle/tooth splits (and is deemed non-restorable).

2. Top tips for prevention

a. Following the identification of ICF and associated aetiological factors, bespoke preventative advice should be delivered, which may include recommendations to:

i. Avoid clenching/grinding/tapping/or holding teeth together
ii. Avoid chewing fingernails/inside of cheeks/pens or using teeth as 'tools' (eg cutting tape/opening bottles/stripping wire, etc)
iii. Avoid chewing on particularly hard or abrasive foods, such as nuts/bone/ice, etc.

b. Additionally, where relevant, the patient should be provided with:

i. An occlusal splint for wear during sleep. In the absence of confirmed (nocturnal) bruxism, for diagnostic purposes, the 'occlusal' surface of the splint may be lightly abraded with 50-micron alumina powder, producing a matt finish – subsequently after a period of wear, shiny marks are left on the splint in any areas of repeated contact with opposing teeth. The patient and splint should be reviewed 4–6 weeks after fitting to assess compliance with splint wearing, and review the splint itself for evidence of damage associated with parafunctional activity
ii. A mouth protector for use during contact sports.

Top tips for restorative management

3. Enamel infractions

See Figures 1 and 2.

a. These defects do not usually require any treatment. However, micro-cracks provide an entry point for diet and tobacco-derived chromophores to penetrate enamel, which may cause staining. Beyond dietary modification and tobacco cessation advice (as applicable), management of this situation should begin with mechanical removal of surface stains. Further to this, a course of bleaching may be undertaken to breakdown and remove sub-surface staining compounds.

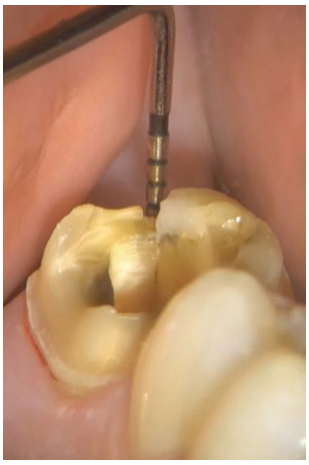

Fig. 1 Restorability assessment confirmed a stained crack-line running mesio-distally through this lower right 6 tooth. A localised 7 mm probing defect was detected at the distal aspect, adjacent to the crack-line, indicating extension of the crack into the root. The tooth was deemed to be not predictably restorable and extracted

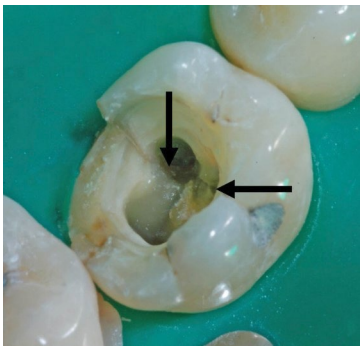

Fig. 2 Restorability of another lower right 6 (the same case as shown in Fig. 2 of Part 1) revealed stained crack-lines extending into the mesial root canal orifices. The tooth was deemed to be not predictably restorable and extracted

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b. Bleached teeth with enamel infractions remain liable to 'rebound' staining unless the enamel surface is subsequently sealed (eg with an adhesively bonded composite resin layer). The long-term maintenance implications of placing such restorations (eg need to periodically polish and ultimately replace) should be discussed within the consent process.

4. Restorability assessment

a. Pre-existing restorations (where present) and defective tooth tissue (caries/unsupported enamel/cracked/fractured cusps) should be removed. Use of magnification and transillumination is recommended within this stage. After taking into account: quantity, quality, distribution of tooth tissue for ferrule effect (+/- crown lengthening surgery), a decision is made as to whether, and how, the tooth can be predictably restored.

b. Where the tooth is deemed to be predictably restorable (and where time allows within the appointment) a definitive direct composite resin restoration (cuspal-coverage in case of posterior tooth) may be placed, or otherwise a provisional restoration should be placed (see section 6 below).

c. Management for a tooth deemed to not be predictably restorable is summarised in section 9 below.

5. Management of the pulp

a. Considerations influencing the decision of whether to try and preserve the pulp of a vital tooth with a traumatic pulp exposure are shown in Table 1.

b. Hydraulic calcium silicate cements (HCSCs) have been recommended for use in VPT in both immature[2] and permanent teeth[3] with traumatically exposed pulps. Both Mineral Trioxide Aggregate (MTA) and Biodentine (Septodont, Saint Maur des Fosses, France) are HCSCs which may be used within pulp capping and pulpotomy procedures, but as such there is limited evidence as to whether one is biologically superior to the other in these situations.[1] However, one factor that influences HCSC selection is that MTA causes grey staining of tooth tissue (unlike Biodentine).[4] Therefore, when an HCSC is indicated for use within the clinical crown or coronal-third of root, Biodentine is the material of choice.

Table 1 Considerations influencing the decision of whether to try and preserve the pulp of a vital tooth with a traumatic pulp exposure

Favouring VPT (eg pulp cap or pulpotomy)	Favouring RCT
Asymptomatic	Symptoms of (irreversible) pulpitis
Immature root/open apex	Root development complete/closed apex
Small pulp exposure (≤1 mm)[1]	Large pulp exposure (>1 mm)
Early presentation (within hours)	Delayed presentation
>50% of clinical crown remaining, supra-gingival cavity margins, and margins in enamel	<50% of clinical crown remaining, and requirement to use pulp chamber/root canal to retain core or post/core

c. VPT and RCT must both be carried out within an aseptic field, achieved via measures including:
   i. Isolation with rubber dam
   ii. Disinfection of the tooth (following isolation) with a cotton wool pledget soaked in a 1–3% sodium hypochlorite solution).

d. Where there is a need to dress the pulp/root canal prior to definitive endodontic management, suitable non-setting intra-canal medicaments should be used, such as:
   i. Non-setting calcium hydroxide, which is both antibacterial and non-staining

> 'The eugenol component may negatively affect the quality of any subsequent [bonding] attempts'

   ii. Ledermix (Aspen Pharmacare Australia, Dandenong South, Australia). This paste has both anti-inflammatory and anti-bacterial properties which makes it particularly suitable for use in cases of symptomatic pulpitis. However, Ledermix can cause stained tooth tissue,[5] so ideally should not be placed above the level of the cemento-enamel junction.

e. In general, the authors suggest that where a cracked or fractured tooth has associated symptoms of irreversible pulpitis, the definitive endodontic management is most predictably managed via RCT.

6. Provisionalisation

a. Where definitive restorative management of the tooth cannot be completed within a single appointment, a provisional restoration is required to provide the following: mechanical protection/bracing for thin/cracked tooth tissue, antibacterial seal over dentine/ pulp, +/- sedative effect for inflamed pulp.

b. In posterior teeth, reduction of guiding cusps by 2 mm and balancing cusps by 1.5 mm is recommended to provide space for placement of adequate bulk of restorative material as a protective overlay.

c. Options for intermediate restorative materials:
   i. **Glass ionomer cement (GIC)** can be quickly placed/shaped/polished, and has the advantages of inherent adhesion to tooth tissue, and reasonable aesthetics (suitable for anterior and posterior teeth)
   ii. **Zinc oxide eugenol (ZOE) cement** (eg IRM, Dentsply Caulk, Milford, USA) combines the advantages of an antibacterial seal (if optimally placed when still 'sticky'), and sedative effect on pulp via its eugenol content.[6] However, the eugenol component may negatively affect the quality of any subsequent attempts for resin bonding within the same cavity.[7] Additionally, whilst the sedative effect of ZOE can be helpful in relieving symptoms in the short-term, the authors have noted that symptoms can return upon removal of the dressing and placement of a non-eugenol containing

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restoration. A final consideration is that IRM is bright white in colour and this may pose an aesthetic issue (albeit as a short-term restoration).

d. A posterior tooth may also be stabilised via its encirclement with a suitable sized/adapted orthodontic band (Fig. 3):
   i. In general bands are usually only placed in situations where ultimately it is considered that the tooth in question is to be restored with a cast cuspal-coverage restoration. Therefore, where contact points are tight, inter-proximal space for the band may be created by use of interdental polishing strips, or where the tooth has been previously restored with class II restorations, a flame-shaped high-speed diamond bur may be used to create space
   ii. An orthodontic band is chosen from a commercially available selection box. A suitably sized band should fit snuggly over the tooth, and after trying-in can be removed with an excavator
   iii. To cement the band, the tooth should be isolated and dried; GIC should be liberally applied circumferentially to the internal aspect of the band; and the band placed over the tooth, and pushed down into position using an orthodontic 'band pusher' (or alternatively cotton wool roll) – asking the patient to bite down to provide the force required for seating. After allowing the material to set (+/- light curing in the case of a resin-modified GIC), excess cement and metal protruding above the occlusal table is removed/polished with a suitable high-speed diamond or white stone. Excess cement at the inter-proximal and gingival aspect of the band can be removed with an ultrasonic scaler
   iv. The patient should be asked to confirm that there are not sharp areas detectable with the tongue, and where present these should be addressed to prevent soft tissue irritation/injury
   v. At a future appointment, when the band is to be removed, it can simply with sectioned with a high-speed bur, loosened with an ultrasonic (if necessary) and removed with tweezers. Remnants of GIC can be polished off or removed with an ultrasonic scaler.

7. Definitive restoration

a. Recommendations for restoration of cracked/fractured posterior teeth:
   i. Provision of cuspal-coverage
   ii. Preferably indirect restoration (eg casting) for molars
   iii. Conservative preparation for indirect restorations (eg onlay vs 3/4 crown, vs full-coverage crown)
   iv. Direct (eg composite resin overlay) or indirect restoration for premolars. Select direct restoration if insufficient tooth tissue for ferrule.

b. Recommendations for restoration of cracked/fractured anterior teeth:
   i. Composite resin restoration if >50% of tissue of the clinical crown remains, and margins can be placed in enamel
   ii. Crown if <50% of coronal tooth tissue has been lost
   iii. RCT and post/core placement required if insufficient tooth tissue for core (to retain casting).

c. For discoloured teeth consider vital or non-vital bleaching (as indicated) prior to definitive restoration.

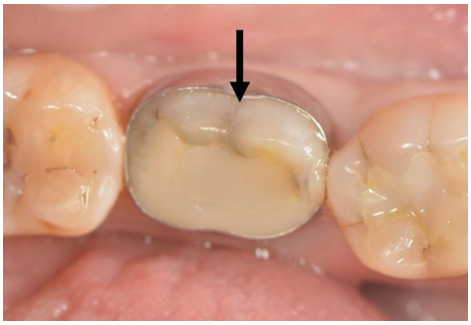

Fig. 3 Lower left 7 with crack (arrowed), stabilised with orthodontic band prior to definitive management

8. Vertical root fracture

a. Where a vertical root fracture is diagnosed in a multi-rooted tooth, it may be possible (following RCT) to undertake resection of the affected root whilst preserving the remaining roots,[8] so facilitating continued function of the tooth. Otherwise, teeth with vertical root fractures are considered to have a hopeless prognosis.

9. Tooth deemed not predictably restorable

a. Following restorability assessment, where a tooth is deemed to be not predictably restorable arrangements should be made for extraction +/- prosthetic replacement as indicated.

b. Where the tooth to be extracted is in the aesthetic zone, and/or a dental implant supported restoration is being considered as the prosthetic replacement (and immediate implant placement is deemed not to be feasible), consideration should be given to using alveolar ridge preservation techniques at the time of extraction. The rationale for this is to minimise the amount of post-extraction bone loss and gingival recession, so optimising the site for prosthetic replacement.[9]

10. Follow-up

It is important to provide long-term follow-up for teeth with ICFs to assess, and deliver timely management for any for endodontic, periodontal or other complications.

We hope that you have found these hints and tips helpful. ■

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